Osteopenia in extremely low birth weight infants (BW <1000 gm)

V. Kamtorn, S. Sun, A. Bautista, J. Marquis

Osteopenia or decreased bone mineralization has been reported with increasing frequency in premature infants associated with a variety of conditions. It has been reported in decrease intake of Ca,and P, block in Vit D metabolism, prolonged total parenteral nutrition (TPN) with or without vit D, Ca and P supplement, copper deficiency, chronically ill infants, chronic lung disease, prolonged use of furosemide and sodium bicarbonate. Our experience indicates that not all preterm infants developed skeletal demineralization inspite of inadequate nutritional and mineral intake. The purpose of this study is to identify the possible etiologic and risk factors associated with this condition.

Material and Method:

Extremely low birth weight infants (ELBW,<1000 gms) who survived >12 wks from July '78 to April '81 were included in the study. Bone demineralization was diagnosed by radiologic bone survey from the 1st to the 16th week of age. Biochemical studies included periodic determinations of Ca, P, & Alk phosphatase. Total calories protein, fat, CHO, Ca, P and vit D intake were calculated weekly.

There were 32 out of 104 extremely low birth weight infants (31%) who survived over 12 weeks of age. Only 20 infants were included in this study. Seven infants were excluded because of late admission, early discharge, or lost x-ray film . All of these babies were on total parenteral nutrition. Enteral feedings were generally not initiated until patients were off mechanical ventilation . A commercially prepared modified cows milk was used in all infants.

Radiographical gradings of osteopenia were defined as follows:

Normal: Normal density of bony cortex with small medullary space.
Grade 1: Cortex remains normal, widening of medullary space.
Grade II. Thining of cortex, widening of medullary space, increased metaphpyseal lucency.
Grade III: Cortex markedly thin, demineralization throughout shaft, irregularity and fraying of metaphyses with splaying and cupping.
Grade IV: Changes of Grade III plus evidence of fractures.

Results

Osteopenia was seen in 14 patients:(2 with Gr.1, 4 with Gr.II, 2 with Gr.III and 6 with Gr.IV). Fracture appeared at approximately 10-12 weeks of age (range 60-131 days, median 73-74 days),involving 1 to 7 sites. It occurred most commonly at humerus (4).

Fourteen osteopenic cases were compared with six control infants. The mean gestational age of the osteopenic infants was 26.36 (SD±0.8) wks and that of the control was 27.0 (SD±0.9) wks. The mean birthweight was 833.6(±30 SD)gms versus 898.3(SD±74)gms. These differences were not significant.

Comparison of fracture and control groups reveal the following:

Table Comparative data, fracture vs control group

	Control	Pt with fracture	Student T P
No. of patients	6	6	
GA(wks)	27±0.9	26±1	NS
BW(gms)	898±74	798±94	<0.05
NPO(days)	18±9	45±18	<0.005
TPN(days)	36±20	61±19	<0.05
Regain B.W.(days)	27±8	27±11	NS
Ca intake in 12 wks(mg)	3619	2258	NS
P intake in 12 wks(mg)	2534	3003	NS
Vit D intake 12 wks(IU)	16065	15200	NS
Kcal intake 12 wks	7406	6724	NS
Prot intake 12 wks(gms)	195	192	NS
Male/female ratio	3/3	5/1	NS*
Cholestasis	2	4	NS*
Alk P	554±62	1537±503	<0.05
O_2 R_x(day)	13±15	45±25	<0.02
IMV (days)	5±5	28±19	<0.01
BPD	0	6	<0.005*
Furosemide(doses)	1±2.4	25±24	<0.02
HCO_3(doses)	19±19	68±83	NS

*Fisher Exact Test

Discussion

Osteopenia occured in 70% (14/20) of extremely LBW infants. Radiological changes were noted at approximately 10 weeks of age. Thirty percent of these infants had fractures at approximately 12 wks of age. Osteopenia may be multifactorial in origin. The potentially important etiological factors include: extreme prematurity and ELBW, prolonged total parenteral nutrition, chronically ill infants requiring prolonged O_2 supplement and ventilatory support, chronic lung disease requiring multiple doses of furosemide, which is also a potent calciuric agent. This study does not indicate direct association of bone demineralization and inadequate vitamin D, mineral and nutritional intake.

Address: V. Kamtorn, MD Assistant Professor of Pediatrics, UMD-New Jersey Medical School. Children's Hospital of New Jersey, 15 South 9th Street, Newark, New Jersery 07107, U.S.A.